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PRELIMINARY OBSERVATIONS MADE BY MR.  
S. HAMAHIRA ON THE GROWTH OF A GIANT  
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PAVONA FRONDIFERA LAMARCK, FOUND IN  
A COVE ON THE SOUTHWESTERN COAST OF  
SIKOKU ISLAND

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PRELIMINARY OBSERVATIONS MADE BY MR. S. HAMAHIRA  
ON THE GROWTH OF A GIANT COLONY  
OF THE MADREPORARIAN CORAL  
*PAVONA FRONDIFERA* LAMARCK,  
FOUND IN A COVE ON THE SOUTHWESTERN  
COAST OF SIKOKU ISLAND

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With Plates IV-V and 2 Text-figures

This paper is to introduce preliminarily the observations of Mr. Sei-ichi HAMAHIRA made on the growth of a giant colony of the madreporarian coral found in Minokosi-Wan, a cove of Tatugusi Bay on the southwestern coast of Sikoku Island, Japan. Tatugusi Bay is located 16.2 km west-northwest of Cape Asizuri, the southwest point of Sikoku Island, and famous for its attractive sights along the coast line and also for the coral fauna on the sea floor, which is evidently remarkable for so high latitudinal situation of the bay. Minokosi-Wan is a small cove located on the west shore and near the tip of Cape Tihiro-Misaki embracing the east of Tatugusi Bay, approximately at  $32^{\circ}46'18''\text{N} \times 132^{\circ}52'14''\text{E}$ . The cove is about 360 m wide at the maximum, about 300 m from the mouth to the head, and with 800 m coast line; the mouth is about 100 m wide. The water is 4 to 5 m deep. The colony of the coral referred to in this paper is identified by Prof. M. EGUCHI of Tohoku University as *Pavona frondifera* LAMARCK, as carinae are more developed and septa are more numerous in this than in *P. decussata* DANA. The colony is situated, as shown in Text-fig. 1 D, along the northern coast of the cove, which is extended roughly from the west to the east.

**Size of the colony**

Mr. Sei-ichi HAMAHIRA of the Tourism Association of the City of Tosa Simizu had noticed the existence of this large colony of *Pavona frondifera* in the cove since ago and measured it for the first time in 1952; it was nearly of a circular outline with a 5 m diameter (Text-fig. 2 A). Seven years later, in 1959, the outline was grown up to a pear shape 23 m in length and 16 m in breadth. Further, in 1966, the length was extended to 44.5 m and the width attained to 24.6 m and the top of the colony reached one meter below the low water surface. The increase in length was much

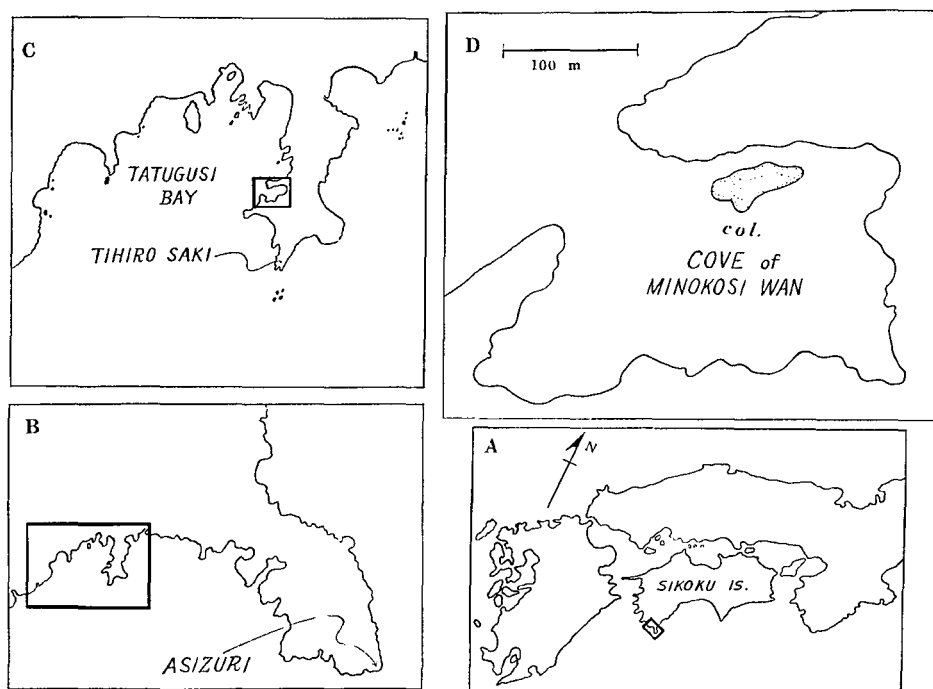


Fig. 1. Maps showing respectively the site of A—Sikoku Island, B—the Cape Asizuri, C—Tatugusi Bay, and D—the cove, Minokosi-Wan. Col. is the outline of the giant colony of *Pavona frondifera* LAMARCK.

more prominent toward the head than to the mouth of the cove, while the increase in width was prominent in the southern half of the colony. The optical section of the giant colony is schematically given by Mr. HAMAHIRA in Text-fig. 2. The profile of the colony seemed to be semispherical in 1952 (Text-fig. 2A).

### Growth of frond

In the winter 1963–64, the coastal water of the southwestern district of Sikoku Island was affected by the severe cold and many fishes, oysters and reef corals inhabiting the floor shallower than three meters were mostly destroyed. According to Mr. HAMAHIRA's observation, the living surface layer of that coral colony was found wholly destroyed in December 1963 and no sign of living structures was discerned in January to March 1964. However, in June 1964, there were found a number of minute whitish living granules over the dead colony surface. These granules were respectively enlarged in June 1965 to 0.5 to 1.0 cm high tubercular processes with a faintly pinkish tint, which were then grown up in June 1966 to form 2–3 cm high fronds. Further appearance of small whitish living granular patches was confirmed in subsequent years over the colony surface. In June 1967, the fronds attained 4–5

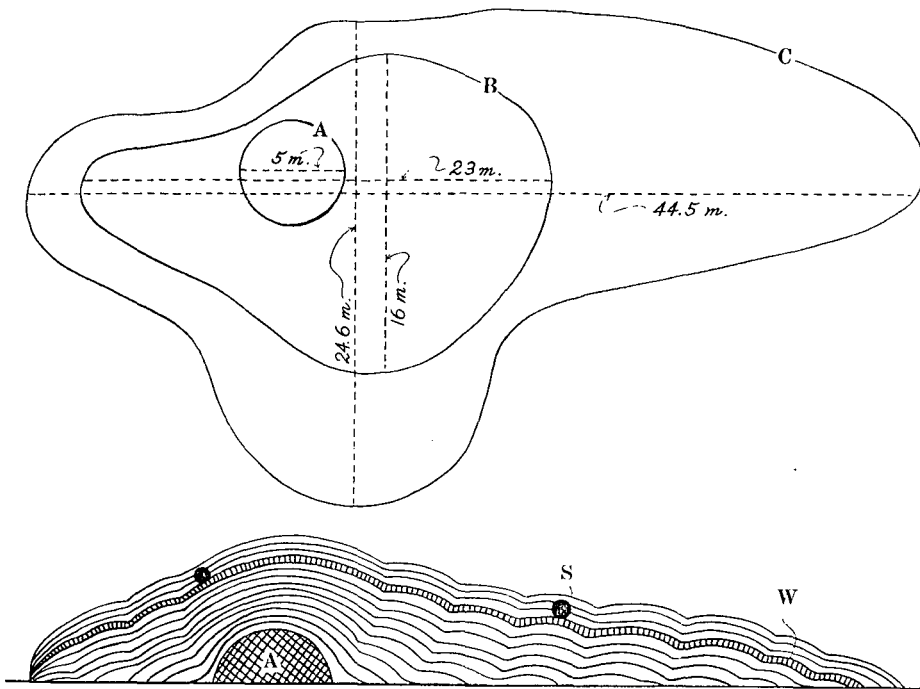


Fig. 2. The outline of the giant colony of *Pavona frondifera* LAMARCK in the cove, Minokosi-Wan. (By Mr. S. HAMAHIRA) Above—Extent of the colony, A in 1952, B in 1959, and C in 1966. Below—Optical section of the colony, A—the colony in 1952, W—the layer damaged by the cold of the winter 1963–64, S—pebble left on the damaged surface in the winter 1963–64.

cm and their distal edge was somewhat thickened. The area covered by living corallum was extended around the base of respective fronds, and several small fronds were found growing out from the surface of the basal encrusting extension thus formed. Since then, the increase in frond height became much less significant, while the peripheral expansion of the corallum became remarkable.

It happened that 50–60 pebbles were left on the colony surface in the winter 1963–64, which was killed by the cold. All of these pebbles are now wholly embedded in the 4–5 cm thick corallum after three years.

### Considerations

The observations of Mr. HAMAHIRA seem to show that the frond of *Pavona frondifera* grows at the rate of about 20 mm in a year at the maximum and the formation of fronds is achieved roughly in three years in this region. The growth of 20 mm in a year is not unusual in the waters where the temperature rises up to 27–30°C in the summer season but seldom drops below 13–15°C in the winter. On the other hand, the extension rate of the colony measured by Mr. HAMAHIRA, 2.5 m to 3 m in a

year, is surprisingly large as compared with the growth rate of fronds. Such a rapid growth can not be expected for reef corals even in the tropics. Evidently, this giant colony of *Pavona* is not really a single colony but a composite one taking in a large number of colonies which are newly developed from planulae every summer along the periphery of the composite colony. It is not known why the rocky substratum allowed the settlement of only *Pavona frondifera*. It is not sure whether or not the colonies developed from planulae shed from different mother colonies can be fused one another. Anyhow, such a rapid growth of the colonial mass as measured by Mr. HAMAHIRA on *Pavona frondifera* would be unacceptable if that colonial mass were really a single colony and the complete fusion between different colonies were rejected.

The features mentioned above seem to imply the following possibilities:

(1) In the circumstances of the cove, Minokosi-Wan, planulae of *P. frondifera* will settle in a very short time after being shed from the mother colony. Thus in the cove with much less water movement, the formation of new colonies will take place just near the mother colony.

(2) Newly formed colonies will fuse one another and contribute to increase the size of the composite mass.

(3) The coral must be much damaged by the cold of the winter 1963-64 but not wholly killed. Reappearance of white granular processes, which were evidently the growing points of live coral, in June 1964 all over the colonial mass means nothing but the regeneration of the survived live structure.

(4) Much more extension of the colony towards the head of the cove might be assigned to a certain relation between the liberation of planulae and some tidal phase.

Observations of Mr. HAMAHIRA are clearly far from complete. However, some of the implications shown above seem to deserve further studies. Of course, his measurement of the frond growth must be an important datum for *P. frondifera* in such higher latitudes.

**EXPLANATION OF PLATES IV-V**

PLATE IV

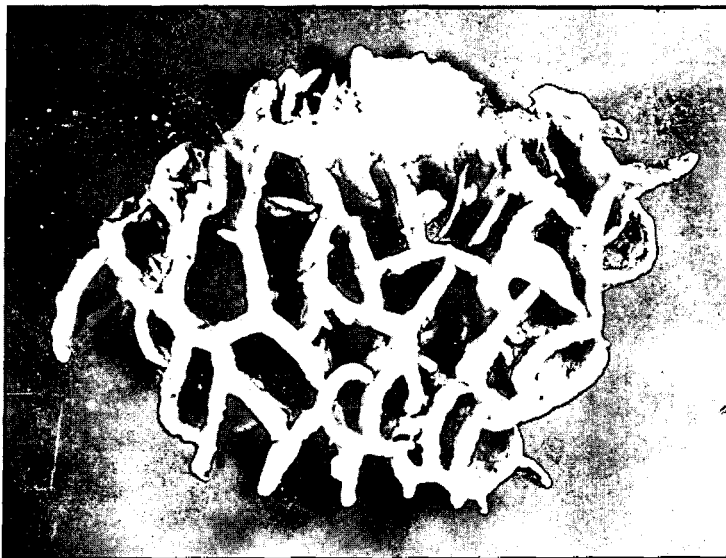
- 1—An air view of Cape Tihiro-Misaki from the north. C is the cove, Minokosi-Wan, and the striped is the terraced farm on the hill slope.
- 2—A piece of *Pavona frondifera* LAMARCK from the cove, Minokosi-Wan.

PLATE V

- 3—The surface of the giant colony of *P. frondifera* LMK. in the cove.
- 4—Fronds in the one year stage of formation, *P. frondifera* LMK.
- 5—Fronds in the two year stage of formation.
- 6—Fronds in the three year stage of formation.

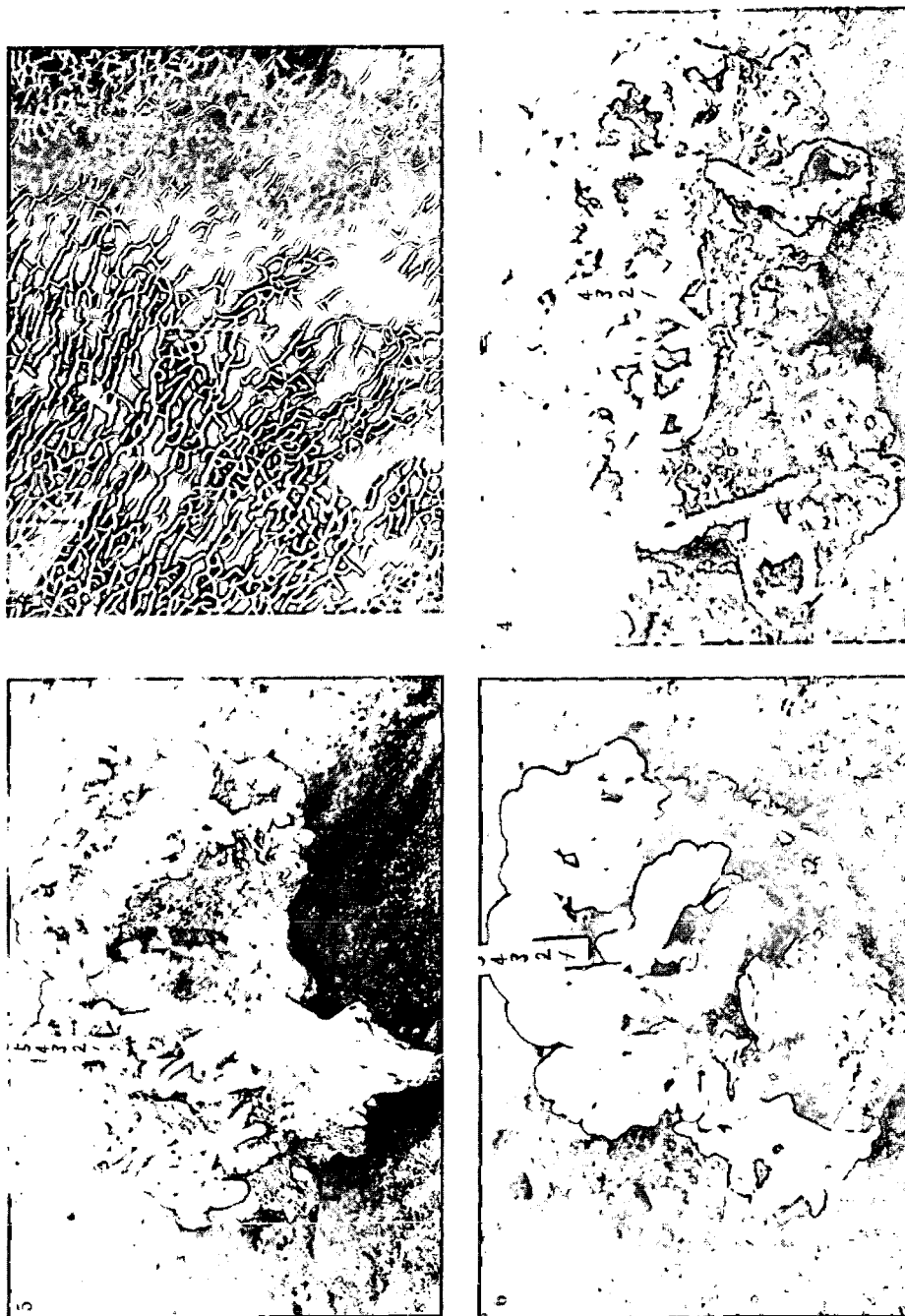
(All photographs by Mr. S. HAMAHIRA.)

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T. TOKIOKA: *Growth of Pavona frondifera*



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